WHAT IS CLAIMED IN:

1. A composite tube comprising at least one axially elongated inner tubular wall, at least one axially elongated outer tubular wall spaced from said inner tubular wall and ribs disposed in the space between the inner and outer walls; wherein said ribs are joined to both said inner and outer walls along a sufficient proportion of the axial length of said walls to maintain the spacing between said walls.

2. A composite tube as claimed in claim 1 wherein said inner and outer walls are concentric.

3. A composite tube as claimed in claim 1 wherein at least some of said ribs are substantially normal to said inner wall.

4. A composite tube as claimed in claim 1 wherein at least some of said ribs are disposed at an angle that differs from normal with respect to said inner tube.

5. A composite tube as claimed in claim 4 wherein all of said ribs are disposed at an angle that differs from normal with respect to said inner tube.

6. A composite tube as claimed in claim 4 wherein at least some of said ribs alternate in the direction of their angle with respect to normal to said inner tube.

7. A composite tube as claimed in claim 4 wherein at least some of said ribs are simultaneously contacted and adhered to at least one said inner and outer tubes, respectively, as well as to a next adjacent rib at substantially the same location of said rib and tube so as to form generally triangular longitudinal truss cells.

8. A composite tube as claimed in claim 7 wherein all of said ribs are alternately disposed at positive and negative angles away from normal with respect to said inner and outer tubes.

9. A composite tube as claimed in claim 7 wherein said ribs are longitudinally contacted and adhered to both of said inner and outer tubes, respectively.

10. A composite tube as claimed in claim 4 wherein at least some of said ribs are simultaneously contacted and adhered to at least one said inner and outer tubes, respectively, at a location that is spaced from the location where the next adjacent ribs are contacted with and adhered to said inner and outer tubes so as to form generally trapezoidal longitudinal truss cells.

11. A composite tube as claimed in claim 10 wherein all of said ribs are alternately disposed at positive and negative angles away from normal with respect to said inner and outer tubes.

12. A composite tube as claimed in claim 1 wherein said ribs extend the entire longitudinal length of said composite tube.

13. A composite tube as claimed in claim 1 wherein at least some of said ribs are disposed helically between said inner and outer tubes.

14. A composite tube as claimed in claim 1 wherein all of said ribs are disposed helically between said inner and outer tubes.

15. A composite tube as claimed in claim 1 consisting essentially of one inner tube and one outer tube.

16. A composite tube as claimed in claim 1 wherein said tubes are concentric and have a substantially circular cross section.

17. A helically shaped article wherein at least some of the flights of said helix comprise an inner and an outer band spaced apart from each other with a plurality of ribs disposed therebetween in supporting relationship to said tubes.

18. An article as claimed in claim 17 wherein said ribs are disposed substantially normal to said inner tube.

19. An article as claimed in claim 17 wherein said ribs are disposed at an angle from normal to said inner band.

20. An article as claimed in claim 17 wherein alternating ribs are disposed at opposite angles from normal to said inner tube.

21. A method of forming an elongated composite tube as claimed in claim 14 comprising:

co-extruding a smaller diameter tube and a larger diameter tube in concentric relation to each other;

extruding a plurality of angularly spaced apart ribs so as to be disposed between, and in supporting relationship to, said smaller and larger tubes whereby forming a composite tube; and

applying an angular twist to said extruded composite tube while it is still in a formable condition, whereby causing said ribs to become helically disposed and shaped relative to said smaller and larger diameter tubes.

AMENDED CLAIMS

[received by the International Bureau on 19 January 2000 (19.01.00);
original claims 1-21 replaced by new claims 1-24 (5 pages)]

1 (3) ~~A~~ composite tube comprising at least one axially elongated, substantially rigid inner tubular wall, at least one axially elongated, substantially rigid outer tubular wall spaced from said inner tubular wall, and a plurality of substantially rigid ribs disposed in the space between the inner and outer walls; wherein at least some of said ribs are disposed at angles other than perpendicular to said inner and outer walls, and wherein at least some of said ribs are joined to both said inner and outer walls along a sufficient portion of the axial length of said walls to maintain the spacing between said walls.

2. A composite tube as claimed in claim 1 wherein said inner and outer walls are concentric.

3. A composite tube as claimed in claim 1 wherein some of said ribs are substantially normal to said inner wall.

Cancel claim 4.

5 (4) ~~A composite tube as claimed in claim 1 wherein~~ all of said ribs are disposed at an angle, that differs from perpendicular, with respect to said inner tube.

6. A composite tube as claimed in claim 1 wherein at least some of said ribs alternate in the direction of their angle with respect to normal to said inner tube.

7. A composite tube as claimed in claim 1 wherein at least some of said ribs are simultaneously contacted and adhered to at least one said inner and outer tubes, respectively, as well as to a next adjacent rib at substantially the same location of said rib and tube so as to form generally triangular longitudinal truss cells.

8. A composite tube as claimed in claim 7 wherein said ribs are longitudinally contacted and adhered to both of said inner and outer tubes, respectively.

9. A composite tube as claimed in claim 1 wherein at least some of said ribs are simultaneously contacted and adhered to at least one said inner and outer tubes, respectively, at a location that is spaced from the location where the next adjacent ribs are contacted with and adhered to said inner and outer tubes so as to form generally longitudinal truss cells having a substantially trapezoidal cross section.

10. A composite tube as claimed in claim 9 wherein all of said ribs are alternately disposed at positive and negative angles away from normal with respect to said inner and outer tubes.

11. A composite tube as claimed in claim 1 wherein said ribs extend the entire length of said composite tube.

~~12.~~ A composite tube as claimed in claim 1 wherein at least some of said ribs are disposed helically between ~~said inner and outer tubes~~.

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~~13.~~ A composite tube as claimed in claim 1 wherein all of said ribs are disposed helically between said inner and outer tubes.

13
~~14.~~ A composite tube as claimed in claim 1 consisting essentially of one inner substantially rigid tube and one outer substantially rigid tube.

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~~15.~~ A composite tube as claimed in claim 1 wherein said tubes are concentric and have a substantially circular cross section.

~~16.~~ A helically shaped article wherein at least some of the flights of said helix comprise an inner and an outer band spaced apart from each other with a plurality of ribs disposed therebetween in supporting relationship to said flights.

17. An article as claimed in claim 16 wherein said ribs are disposed substantially perpendicular to said inner band.

18. An article as claimed in claim 16 wherein said ribs are disposed at an angle from perpendicular to said inner band.

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19. An article as claimed in claim 18 wherein alternating ribs are disposed at opposite angles from perpendicular to said inner band.

20. A method of forming an elongated composite tube comprising spaced apart at least one inner and at least one outer walls and ribs helically disposed between said inner and outer walls in supporting and supported relation to said ribs, wherein said method comprises:

co-extruding a smaller diameter tube and a larger diameter tube in concentric relation to each other;

extruding a plurality of radially spaced apart ribs so as to dispose them between, and in supporting relationship to, said smaller and larger tubes whereby forming a composite tube; and

applying a radial twist to said extruded composite tube while it is still in a formable condition, by causing said walls to axially rotate relative to the axis of extrusion; whereby causing said ribs to become helically disposed and shaped relative to at least two adjacent of said walls along at least a portion of their axial length.

21. A composite tube as claimed in claim 16 wherein all of said ribs are alternately disposed at positive and negative angles, respectively, with respect to a perpendicular to said walls.

~~22. A method as claimed in claim 20,~~ wherein said walls are concentric.

~~23.~~ A method as claimed in claim 20 wherein a cross section of at least one of said tubes is substantially circular.

24. A method as claimed in claim 20 wherein at least some of said ribs are angularly disposed relative to a perpendicular to at least one of said tubes, and wherein adjacent ribs are disposed are alternating positive and negative angular relationship with ~~said perpendicular.~~

STATEMENT UNDER ARTICLE 19

Favorable consideration of this application is solicited.

Claim 1 has been amended to more particularly define the instant invention. Claim 3 has been amended to delete "at least" therefrom. Claim 4 has been canceled since its subject matter has been incorporated into claim 1. The dependencies of claims 5, 6, 7 and 9 have been change for consistency. Claim 21 has been added dependent from claim 1 and specifically claiming that the ribs are at alternating angles with respect to a perpendicular to the tubes. Claim 20 has been amended to better describe the instant invented method of making the claimed product. Claim 22-24 have been added to show various preferred embodiments of the claimed method.

The four (4) references cited by the examiner have been considered and the claims of this application amended to avoid the inadvertent applicability of the disclosures of these references. Specifically, the instant invention is directed to multiple (double or more) walled pipe having a relatively rigid outer wall, a relatively rigid inner wall, and a series of rigid ribs disposed between at least two of the walls at angles that diverge from the perpendicular, with respect to the walls. The broadest claims are directed to this scope of invention. In a preferred embodiment, these ribs are disposed in a helical configuration and in a most preferred embodiment, the oppositely slanted helical ribs are joined to the inside and outside, respectively of the outer and inner tube walls so as to form triangular or trapezoidal cells that preferably extend helically between the walls. More specific claims are directed to these aspects of this invention.

None of the cited references discloses a structure as claimed. Specifically, no cited reference shows the combination of a rigid double walled pipe with ribs between the walls where the ribs are not perpendicular to the walls, but rather at an angle with respect to the perpendicular to the walls. Certainly, no reference discloses that such ribs are helically shaped. No cited reference discloses such a double walled pipe with a smooth outer wall.

The Sorensen patent discloses a collapsible hose. In order for the hose to collapse, the ribs too must be in a bendable form. This is particularly true of the embodiment shown in Fig. 3 of the reference. Note column 2 where these ribs are referred to as flexible retainer members. By way of contrast, the instant ribs must be rigid. It is clear that the differences between the structure disclosed by the reference and that of the instant application are due to the different uses to which they will be put. The reference structure is for a suction fire hose. It must be flexible and be able to collapse for storage on a truck bed. It must withstand expansive forces acting on it by the water being sucked there through. The instant claimed article is directed to a core structure for use in wrapping flat, sheetlike materials, such as plastic film. It necessarily must be rigid and resist being crushed because of the compressive effect of the material wound on the roll. Because of the different structures of the tubes being supported and the uses to which these article are being put, their structure is necessarily different. One could no more effectively wind plastic shrink wrap film on a fire hose than one could efficiently pass fire water around a corner through the rigid structure of the instant invention. It is to be noted, however, that the instant invented structure with a set of helical ribs could find good use as a very strong fire hose.

No reference discloses the method of making such a double walled pipe as claimed where the walls (that is the whole extrudate) are rotated relative to the axis of extrusion so as to twist the ribs into a helical form. No reference has been cited for this proposition.

One use of this double walled pipe is that it can be cut following the helical pattern of the ribs, or across the helical pattern of the ribs, to form a slinky like toy. More importantly, one significant use of this product is as a core upon which can be wound plastic film, carpet, textile material, paper and other flat goods. This double walled core is very light weight and has unexpectedly high crush resistance on a weight basis. Neither of these uses is disclosed in any cited reference.

It is therefore urged that the instant claims be identified as being allowable.